FLOOD PLAIN MANAGEMENT STUDY

BELUGA SUBBASIN STREAMS

ALASKA RIVERS COOPERATIVE STUDY

Susitna River Basin, Beluga Subbasin
Matanuska-Susitna and Kenai Peninsula Borough
Alaska

September, 1982

Prepared by the
U.S. Department of Agriculture
Soil Conservation Service
Economics Research Service
Forest Service

In cooperation with the
State of Alaska
Department of Natural Resources
Department of Fish and Game

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Edward Grey, Hydraulic Eng. S.C.S.

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Graphics by

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FOREWORD

The flood hazard information in this report will serve as a basis for local government and planning groups in formulating flood plain land use and management programs, adopting regulations, and providing the public with information concerning flood hazards along the Kustatan River, McArthur River, Chakachatna River, Chuitkitnachna River, Nikolai Creek, Old Tyonek Creek, Tyonek Creek, Chuitna River, Three Mile Creek, Beluga River, Olson Creek, Theordore River, Lewis River, Ivan River, Skwentna River, Shell Creek, Yentna River, Donkey Creek, Red Creek, Johnson Creek, Kichatna River, Nakochna River, East and West Forks of the Yentna River, Talachulitna River and Fourth of July Creek.

The Soil Conservation Service implemented the technical phases of the study. The State of Alaska and Matanuska-Susitna Borough, Alaska Soil Conservation District assisted in providing land use data, obtaining permission for field surveys, and made available materials to be used for the study. They will distribute the report and make interpretations of the study data so it may be used effectively in local flood plain management programs. The State of Alaska, Matanuska-Susitna Borough and the SCS encourage the immediate use of the flood hazard information in implementing these programs and upon request will assist in the interpretation and use of the data presented in the report.

The cooperation and assistance given by other federal, state, and local agencies and property owners in the collection of data for this report are greatly appreciated.

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INTRODUCTION

Local Study Needs and Authority

The Matanuska-Susitna Borough requested the Soil Conservation Service, through the Alaska Soil Conservation District and Alaska Department of Natural Resources, to carry out flood studies of several streams in the Beluga Subbasin. State land disposals are underway in this locality and there is a need to define the 100-year flood boundaries along the streams to insure that flood plain lands will be managed accordingly. This report defines the areas subject to flooding so that adequate flood plain management programs can be implemented that will regulate land use and development in flood prone areas. Such management programs will reduce potential flood damage, assure wise land use, and preserve and enhance the physical environment in the vicinity of the communities.

This report will include the Kustatan River, McArthur River, Chakachatna River, Chuitkitnachna River, Nikolai Creek, Old Tyonek Creek, Tyonek Creek, Chuitna River, Three Mile Creek, Beluga River, Olson Creek, Theordore River, Lewis River, Ivan River, Skwentna River, Shell Creek, Yentna River, Donkey Creek, Red Creek, Johnson Creek, Kichatna River, Nakochna River, East and West Forks of the Yentna River, Talachulitna River, and Fourth of July Creek. The details of work items involved in this analysis and authorities for USDA and State of Alaska agency participation are set forth in the Alaska Rivers Cooperative Study Plan of Work for the Beluga and Susitna Subbasins dated April 1980. Four other flood hazard reports have been published under the Susitna Cooperative Study Plan of Work: "196 Mile, Caswell, Sheep, Goose, Montana, Answer and Birch Creeks;" "Kroto, Rabideux, Trapper and Peters Creeks;" and "Troublesome, Byers and Honolulu Creeks, East and Middle Forks of Chulitna River;" and "Kashwitna River, Wasilla, Cottonwood, and Lucile Creeks."

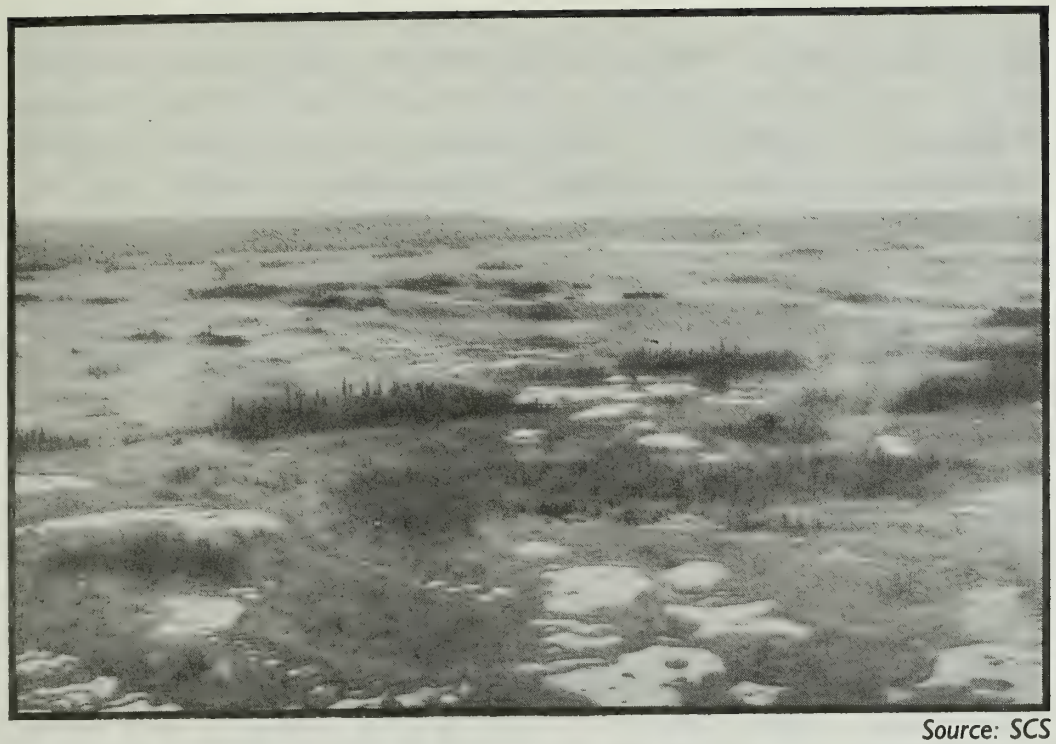
The U.S. Corps of Engineers has published a Flood Plain Information Report on a portion of the Talkeetna River and a Flood Insurance Study on Willow Creek and the upper portion of the Little Susitna River and the "Expanded Flood Plain Information Study, Willow, Alaska," 1980, which are within the Susitna River Basin.

DESCRIPTION OF THE STUDY AREA

The flood hazard report concerns the above mentioned streams and is bounded by the Alaska Mountain Range on the north and west, Cook Inlet to the south, and the drainage divide between the Kahiltna and Yentna Rivers and the divide between the Yentna River and Alexander Creek on the west. For details see "Location Map" Figure 1. The study area, for flood hazard concerns, encompasses about 9,263 square miles. The southern boundary of the area is about 30 miles west of Anchorage by air. The area is within the USGS hydrologic unit number 1905002. This number designates the Cook Inlet subregion of the Southcentral Alaska Region.

Source: SCS

The upper portions of the Beluga River with snow covered Alaska Range in background and the Triumpvirate Glacier in the foreground. July 16, 1981.



Source: SCS

Typical lowland vegetation cover is black spruce, sedges and grass in the wet areas.

Source: SCS

Much of the area is covered with a thick growth of timber which is birch and white spruce with intermittent areas of grass and low brush.

Elevations range from mean sea level to about 17,400 feet above sea level at the top of Mt. Foraker in the Mt. McKinley National Park. The area generally slopes to the south. The Yentna River, which drains into the Susitna River and heads in the Alaska Mountain Range, drains the northernmost streams and the rest of the streams drain into the Cook Inlet at sea level elevations.

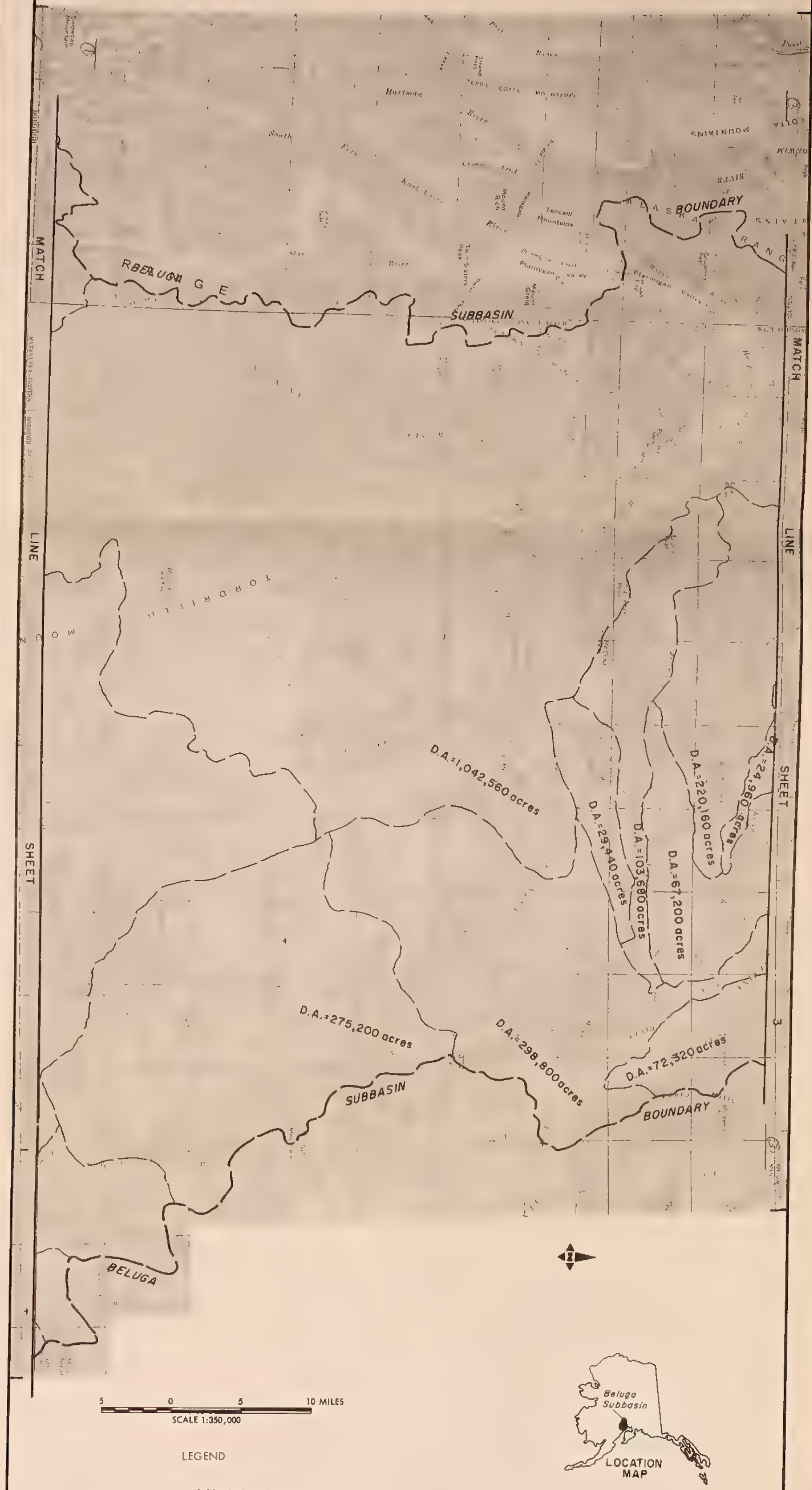
Areas adjacent to the Cook Inlet are nearly level to undulating. Low hills with irregular slopes are prominent and poorly drained bogs and other wetlands are common.

Below timberline, about 2,000 feet above mean sea level elevation, on the better drained soils paper birch-white spruce stands are the predominant vegetation. Black spruce is predominant on the poorly drained soils associated with numerous sphagnum bogs. Cottonwood, alder and willow are common in the flood plains adjacent to the streams. Vegetation above timberline, 2000 feet to 4000 feet elevation, is predominately of the tundra type. At higher elevation much of the area is covered with snow and ice.

Stream channel slopes range from about 3 feet per mile in the lower reaches to about 3000 feet per mile in the mountains. Access to the area is by air or water in the summer and in the winter airplanes on skiis, snowmobiles, and dog sleds can be used.

The climate of the area is influenced by marine conditions in the south and continental conditions in the east. The temperature range is from a minus 45 degrees to 85 degrees F. The average daily maximum temperature in the summer is in the upper 60's with low 60's being common. Temperatures of 32 degrees F or lower have been recorded during every month of the year. Average maximum winter temperatures range from below zero to the midteens.

The freeze-free period averages about 80 to 95 days. Average annual precipitation ranges from about 28 inches in the southwest to about 60 inches in the mountains. In the southern portion of the area, over half of the precipitation occurs from June 1 through the end of September.



LEGEND

Subbasin Boundary

Watershed Boundary

SHEET 2 OF 3

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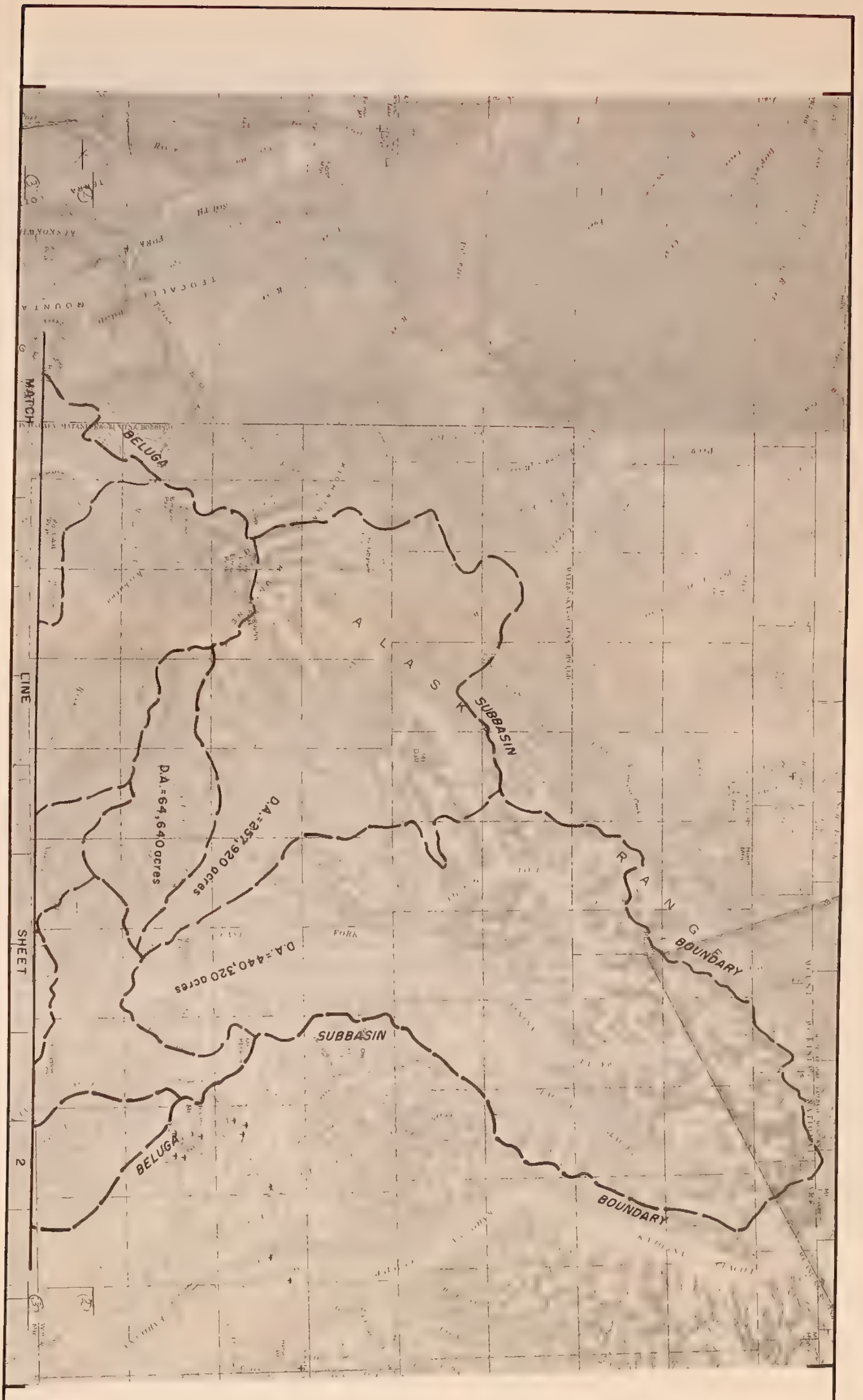
ALASKA

VICINITY MAP

BELUGA SUBBASIN STREAMS



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VICINITY MAP

BELUGA SUBBASIN STREAMS

SHEET 3 OF 3

LEGEND

Approximate 100 Year Flood Hazard Area

Flow Arrow

Limits of flooding may vary from actual location on the ground.

SCALE 1:63,360

Base prepared from USGS 1:63,360 quads

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ALASKA

FLOOD PLAIN MANAGEMENT STUDY

SKWENTNA, TALACHULITNA AND YENTNA RIVERS

SHEET 10 OF 17

Source: SCS

Sphagnum bogs and other wetlands are common.

FLOOD HISTORY

Development in the area is sparse and flood history is almost nonexistent. In the summer of 1979 Strandline Lake broke out causing a large flow down the Beluga River. An oil company bridge across the Beluga River was washed out by the flood flow, also some heavy equipment was damaged. Beluga lake water surface raised 32 feet in a matter of hours.

There are other streams with glacial lake break out potential. They are the Chakachatna River and McArthur River. Chakachatna experienced a recorded outbreak peak in August 1971.

Channel obstruction is a factor which is significant in assessing flood damage. Ice jams, stream glaciation and log jams have been witnessed on streams in the Susitna River Basin and are considered a frequent occurrence on many of these streams. Sufficient data is not available for analyzing frequencies and locations of the potential damage caused by such channel obstructions.

FLOOD POTENTIAL (Present Conditions)

Flood Hazards

Present damageable property in the area consists of scattered cabins, most of which are for seasonal use, and road crossings. Damages to these properties from a 100-year event is estimated to be less than $150,000 with average annual damage totaling less than $8,000. A detailed damage analysis concerning the effect of flooding on stream fishing is beyond the scope of this study, however, under certain conditions, flooding could severely disrupt stream sports fisheries and have a long term negative impact on commercial fisheries. See Appendix B, Exhibit 2, for area flooded by the 100-year event along the streams.

The area subject to inundation by the 100-year frequency storm event under present conditions is about 67,780 acres.

Technical Data and Related Material

The technical data and related material needed for the intended uses of this study are provided as figures, exhibits and tables in this report.

The Flood Hazard Area Maps, Exhibit 1 of Appendix B, show the area inundated by the 100-year flood. The limits of the 100-year flood line are approximate and may vary on the ground somewhat from that shown. These flood hazard maps can be used to determine the location of points in question and their appropriate relationship to the 100-year flood frequency. They may be used for flood plain management decisions, general planning, and other purposes which require the approximate location of the 100-year flood plain.

The basic data used for determining the flood hazard information and peak discharge-frequency analysis in this report is on file in the office of the U.S. Department of Agriculture, Soil Conservation Service, 2221 E. Northern Lights Blvd., Suite 129, Anchorage, Alaska 99504.

FUTURE FLOOD POTENTIAL

The Matanuska-Susitna and Kenai Peninsula Borough are participants in the HUD Flood Insurance Program administered by the Flood Insurance Administration. This participation guarantees that federally subsidized flood insurance coverage is available to owners and occupiers of all buildings and mobile homes (including contents) within the subbasin.

As required by the HUD Program the Borough has adopted land use management regulations which:

1. Insure that all new construction is designed to minimize flood loss, and

2. Require that all new construction or substantial improvements to existing structures have the first floor (including basement) level at or above the 100-year flood elevation and that all utilities be flood proofed.

With flood plain management regulation in effect it is expected that future residential, commercial, and industrial flood plain development will be such that flood damages to these properties will not increase above present levels. This presupposes that flood plains will be identified and used as a tool and a means for enforcing local ordinances and that the ordinances themselves are enforced. Should this fail to occur, damage potential will increase with population growth.

Although the damage threat to occupied buildings is expected to be arrested, it is doubtful that the same will be true of highways and railroads. Transportation networks are often found in and adjacent to flood plain lands as a result of construction costs. Even when flood damage costs are added to construction, operation, and maintenance costs, it often remains less expensive to build on flat lowland areas than on more rugged upland terrain.

FLOOD PLAIN MANAGEMENT

Management Programs

Regulatory measures presently adopted do not prevent flooding but, instead, reduce the threat of damage or loss of life from floods by discouraging development of homes and other buildings on floodplains. Without additional measures damage to existing property will continue and road and bridge related damages are likely to increase. As a means to minimize this situation the following alternatives are suggested.

1. For Existing Properties:

   a. Permanent measures built as an integral part of the structure, such as raising the elevation of the structure, water-proofing of basement and foundation walls, anchor and reinforce floors and walls, and use water-resistant materials.

   b. Contingency measures which require action to be taken to make them effective, such as manually closed flood gates and removable bulkheads.

   c. Emergency measures carried out during floods according to prior emergency plans, such as sandbagging, pumping, and removal of contents to flood-free areas.

   d. Reclamation of flood plains which includes the permanent evacuation of developed areas subject to inundation and the acquisition of these lands by purchase or land trades, the removal of structure, and the relocation of the population from such areas.

   e. Use of flood watch or warning systems to provide advance notice of impending flood danger.

f. Buildings and mobile homes within or adjacent to the delineated flood hazard areas in Appendix A of this report should carry flood insurance on the structure and its contents. Although this will not reduce existing damage potential, it will have the positive effect of spreading the flood hazard risk.

2. For Future Road and Bridge Construction

   a. When analyzing proposed alternative transportation routes, the costs of potential flood damage will continue to be investigated and included for use in the decision making process.

   b. Construction designs will continue to reflect sound engineering judgement with regards to flood hazard potential. This includes the analysis of soils, geology, hydrology and hydraulics, as well as adequacy of construction materials.

Recommendations

It is not the intent of this report to provide solutions to flood problems in the study area; however, it does furnish an information base for the adoption of an overall flood plain management program. Other management programs dealing with environmental values of flood plains may also benefit from this information. Following are recommendations which should be emphasized during development and implementation of this program.

1. Adopt and/or enforce flood plain regulations in compliance with the National Flood Insurance Program as a minimum. The regulations should address such things as minimum floor elevations, floodways, greenbelt areas, adequate drainage facilities, building and housing codes, and sanitary codes with specific flood hazard provisions for all new construction.

2. Consider nonstructural measures for flood prevention such as flood plain acquisition, flood proofing, and flood forecasting and warning systems. Federal cost sharing for these measures may be available under Section 73(b) of Public Law 93-251. The National Weather Service of the National Oceanic and Atmospheric Administration issues frequent warnings of potential flood producing storms. Frequently the flood warnings are preceded by a "severe weather or flood watch."

3. Include in land development ordinance the provision for on-site runoff and sediment storage. A continuous maintenance program needs to be provided for these types of measures.

4. Owners of property subject to flood damage (including areas adjacent to the delineated flood hazard areas) should be encouraged to purchase flood insurance on their buildings, mobile homes, and their contents.

5. Develop a regular maintenance program to keep all hydraulic structure openings, approach channels, and outfall channels clear of sediment and debris.

INVESTIGATIONS AND ANALYSES

The hydraulic and hydrologic investigations followed procedures in the SCS publications National Engineering Handbook, Section 4, Hydrology (NEH-4) and Section 5, Hydraulics (NEH-5), and other technical references.

Hydraulics

Elevation-discharge relationships were developed for a few valley sections assuming normal flow and using Manning's flow equation. The hydraulic parameters of the channel and flood plain for the conditions existing prior to 1981 were used in the computations. High water marks, stream gage records, and other historical flood data were used in checking the accuracy of the computed water surface. There are three stream gages located in the study area. One in Skwentna River near Skwentna, with records which can be used for peak-frequency analysis. The other two are helpful in locating flood lines but the Chakachatna River near Tyonek gage is at the mouth of Chakachamna Lake and is not representative of peak discharge from the area; the Chuitna River near Beluga has too short of a record, 1975-1981, for development of reliable peak-frequency curves.

Hydrology

Peak frequency (annual series) studies were made by the USGS for all of Alaska. The USGS published a regional analysis, "Flood Characteristics of Alaskan Streams," Water Resources Investigations 78-129, dated 1979, which presents regional equations for two areas in Alaska, Area I and Area II.

The study area is located in Area II. Peak-frequency curves were developed using the equation proposed by USGS and by use of the Log-Pearson Type III method. Peaks calculated by these two methods for given storm frequencies were compared to one another to determine the adequacy of the regional equation for this study. From these comparisons it was determined that the regional equation was inadequate and the following method was used to develop peak-frequency curves.

Twenty-six stream gages within the Southcentral Region were used to develop peak-frequency curves in an effort to obtain more reliable peaks for the study area.

Thirteen of these gage records were discarded because watershed characteristics and/or drainage areas were not representative of the study area and/or the time of stream gaging was too short for adequate frequency analysis. Eleven of the gage records, on streams within the Cook Inlet drainage, were used to make a final determination of peak-frequency curves to be used in this study area.

An envelope for high, medium, and low peak discharge curves, for the 2-year, 10-year, 50-year, 100-year and 500-year events were developed. (See Appendix E, Exhibit 5, 6, 7, 8, and 9 of the "Flood Hazard Study for 196 Mile, Caswell, Sheep, Goose, Montana, Answer, and Birch Creeks" by SCS, 1981.) These curves and watershed characteristics such as watershed slope, channel length and slope, mean elevation, land cover and average annual precipitation, were used to develop a peak-frequency curve for each watershed.

The peak discharge for each area for the 10-, 50-, and 100-year storm events was taken from these curves and used to determine the approximate area inundated.

GLOSSARY

ANNUAL SERIES - A frequency series in which only the largest value in each year is used, such as the annual floods.

CFS - Abbreviation for cubic feet per second. The rate of discharge or flow of water representing a volume of 1 cubic foot passing a given point during 1 second.

CHANNEL - A natural or artificially created open conduit that periodically or continuously conveys water. River, creek, stream, branch, and tributary are some of the terms used to describe channels.

CROSS SECTION (stream or valley) - The shape of a channel, stream, or valley viewed across the axis. In watershed investigations it is determined by a line approximately perpendicular to the main path of water flow, along which measurements of distance and elevation are taken to define the cross-sectional area.

CSM - Abbreviation for cubic feet per second per square mile. (Rate of discharge per square mile of drainage area.)

DRAINAGE AREA - (D.A.) The area, measured in a horizontal plane, which drains into a stream at a specified location. See watershed.

FLOOD - An overflow or inundation of normal dry lands from a stream or other body of water; the high streamflow overtopping the banks of a stream; or a high flow as measured by either stage or discharge.

FLOOD HAZARD AREA PHOTOMAP - A photographic background map that indicates areas likely to be flooded by the 100-year frequency or the one percent chance flood (it has one chance in 100 of being equaled or exceeded in any given year) from an adjoining stream or water body.

FLOOD CREST - The maximum stage or elevation reached by the waters of a flood at a given location.

FLOOD FREQUENCY - The average interval of time between floods equal to or greater than a specified discharge or stage. It is generally expressed in years. Following are examples:

10-year flood or 10-year frequency flood. The flood which can be expected or exceeded on an average once in 10 years; and which would have a 10 percent chance of being equaled or exceeded in any given year.

50-year flood ... two percent chance ... in any given year.

100-year flood ... one percent chance ... in any given year.

500-year flood ... two-tenths percent chance ... in any given year.

FLOOD HAZARD - A general term meaning the risk to life or damage to property from overflows of rivers or stream channels, extraordinary waves or tides occurring on lake or estuary shores; floodflows in intermittent or normally dry streams; floods on tributary streams; floods caused by accumulated debris or ice in rivers; or other similar events.

FLOOD PEAK OR PEAK DISCHARGE - The highest value of the stage or discharge attained, thus, peak stage or peak discharge.

FLOOD PLAIN OR FLOOD-PRONE AREA - The land area situated on either side of a channel or body of water which is subject to flooding.

FLOOD PLAIN MANAGEMENT - The operation of an overall program of corrective and preventive measures for reducing flood damage, including but not limited to emergency preparedness plans, flood control works, and land use and control measures.

FLOOD ROUTING - Determining the changes in a flood wave as it moves downstream through a valley or through a reservoir (then sometimes called reservoir routing). Graphic or numerical methods are used.

FREQUENCY-DISCHARGE-ELEVATION - The relationship of the flood frequency of discharges and the water elevations resulting from these discharges at a surveyed cross section or other point along a stream. This data may be shown as a plotted curve or in table form.

GREENBELT AREA - A strip of land kept in its natural or relatively undeveloped state or in agricultural use which is planned around the periphery of urban development or in the flood plain of a stream or body of water.

HEADWATER - (1) The source of a stream. (2) The water upstream from a structure or point on a stream.

MANNING'S "n" VALUE - A coefficient of roughness in Manning's flow equation for determining stream velocities.

RIGHT FLOOD PLAIN - The flood plain on the right side of a river, stream, or watercourse, looking downstream.

RUNOFF - That portion of the precipitation on a drainage area that is discharged from the area in stream channels. Types include surface runoff, ground water runoff, or seepage.

SEDIMENT - Solid material, both mineral and organic, that is in suspension, and is being transported, or has been moved from its site of origin by air, water, gravity, or ice, and has come to rest on the earth's surface.

STREAM - Any natural channel or depression through which water flows either continuously, intermittently, or periodically, including modification of natural channel or depression.

STRUCTURE - Anything constructed or erected, the use of which requires a more or less permanent location on or in the ground. Includes but is not limited to bridges, buildings, canals, dams, ditches, diversions, irrigation systems, pumps, pipelines, railroads, roads, sewage disposal systems, underground conduits, water supply systems, and wells.

SUPERCRITICAL FLOW - Those conditions of flow for which the depth is less than critical and the velocity is greater than critical. Critical flow is the term used to describe open channel flow when the discharge is maximum for a given specific energy head, or stated conversely, those which exist when the specific energy head is minimum for a given discharge.

WATERSHED - The area contributing direct runoff to a stream. Usually it is assumed that base flow in the stream also comes from the same area. However, the ground water watershed may be larger or smaller.

CONVERSION TABLE

Multiply inch-pound units	by	to obtain SI units
cubic feet per second (ft^3/s) (m^3/s)	0.0283	cubic meters per second
cubic feet per second per square mile [$(ft^3/s)/mi^2$] [$(m^3/s)/km^2$]	0.0109	cubic meters per second per square kilometer
square miles (mi^2)	2.589	square kilometers (km^2)
feet (ft)	0.3048	meters (m)
inches (in.)	2.540	centimeters (cm)
degrees Fahrenheit (degrees F)	5/9 (degrees F-32)	degrees Celsius (degrees C)

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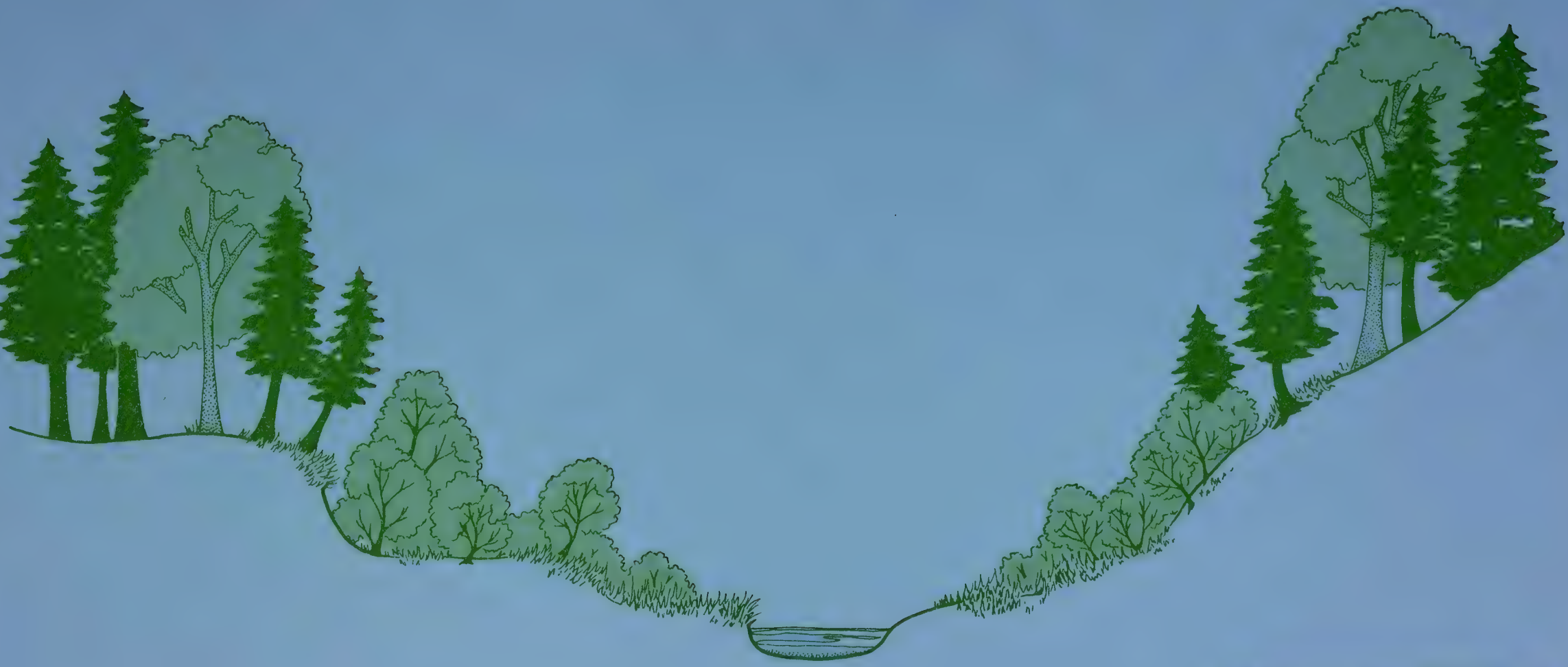
APPENDIX A

Table 1 - Present Conditions Frequency Discharge

Table 1. Present Conditions: Frequency-Discharge Data,
Beluga Subbasin Streams
Matanuska-Susitna and Kenai Boroughs, Alaska

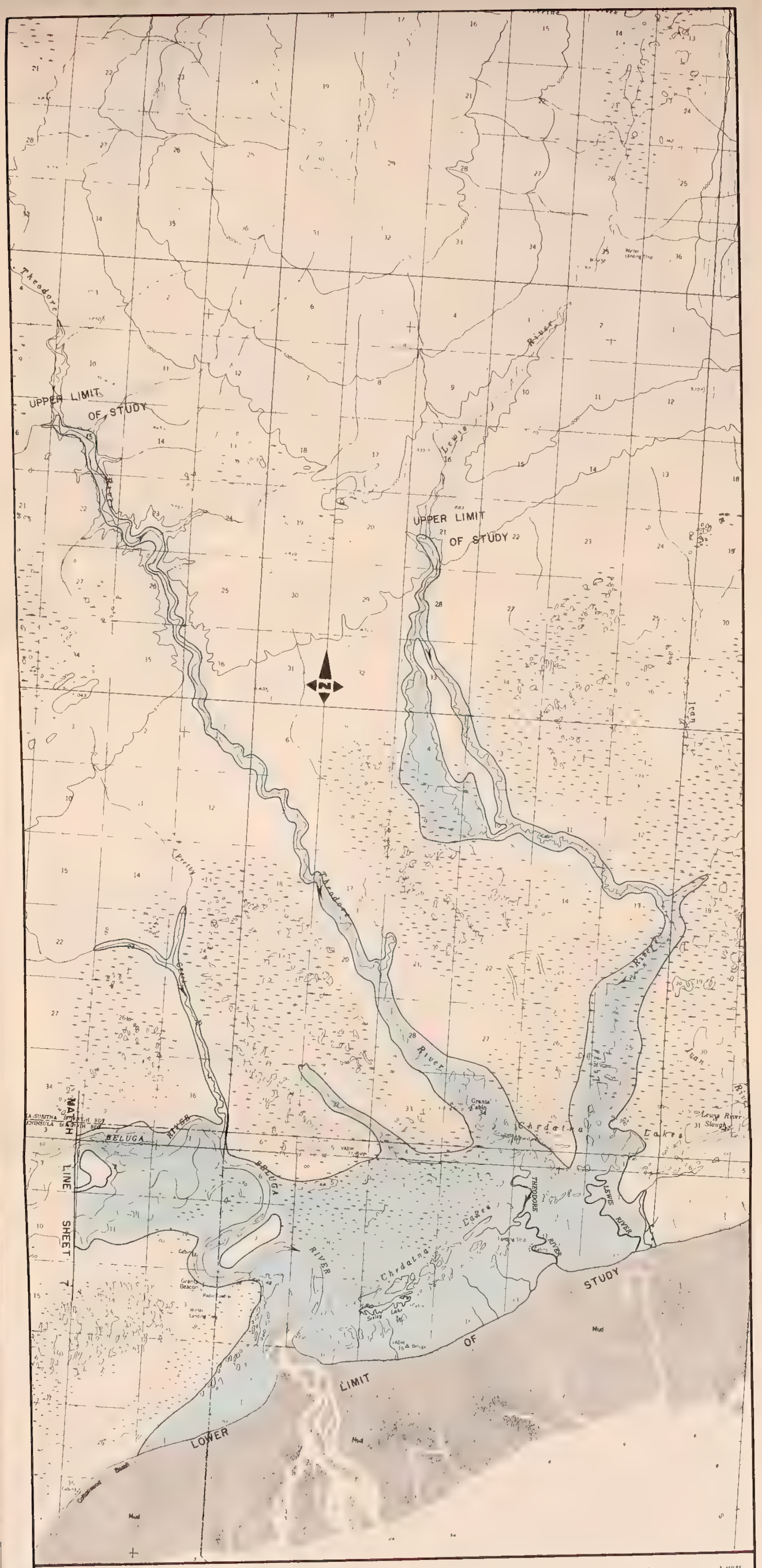
Stream Name and/or Reach	D.A. Sq.Mi.	Peak Discharge (c.f.s.) 10-Year	50-Year	100-Year
McArthur River	1,743	35,200	48,000	53,000
Kustatan River	156	6,620	8,850	9,830
Chakachatna River	1,347	31,000	42,200	47,760
Chuitkitnachna River	21	1,670	2,230	2,500
Nikolai Creek	80	4,180	5,600	6,160
Old Tyonek Creek	33	2,280	3,030	3,330
Tyonek Creek	23	1,780	2,390	2,650
Chuitna River	145	6,200	8,250	9,140
Three Mile Creek	31	2,150	2,900	3,260
Beluga River	893	21,500	28,400	31,360
Olson Creek	13	1,220	1,640	1,810
Theodore River	126	5,750	7,700	8,440
Lewis River	65	3,600	4,800	5,330
Ivan River	55	3,250	4,330	4,730
Skwentna River (below Hays Inlet)	1,629	32,900	43,000	47,240
Shell Creek	41	2,640	3,500	3,850
Yentna River (below Red Creek Inlet)	1,929	38,400	50,400	54,470
Donkey Creek	113	5,030	6,690	7,350
Red Creek	46	2,880	3,850	4,230
Johnson Creek	109	5,200	6,850	7,580
Johnson Creek (below Red Creek)	162	6,620	8,800	9,830
Kichatna River	344	11,450	15,200	16,560
Nakochna River	39	2,500	3,330	3,740
Kichatna River (below Nakochna River)	488	14,500	17,600	20,640
Yentna River (at West and East Fork Confluence)	1,192	26,000	34,000	38,140
East Fork-Yentna River	688	18,000	23,800	26,280
West Fork-Yentna River	403	12,700	16,700	18,420
Fourth of July Creek	101	4,830	6,400	7,170
Talachulitna	430	13,200	17,500	19,010



APPENDIX B

Map Index

Flood Plain Management Area Maps



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SOIL CONSERVATION SERVICE
BELUGA SUBBASIN
ALASKA

FLOOD PLAIN MANAGEMENT STUDY

BELUGA, LEWIS AND THEODORE RIVERS, PRETTY CREEK

SHEET 9 OF 17


UPPER LIMIT OF STUDY
CAPPS GLACIER
UPPER LIMIT OF STUDY
CHICKALOON
KENAI
MATANUSKA-SUSITNA PENINSULA
BOROUGH
BOROUGH
BELUGA
LAKE
Coal Creek Lake
UPPER LIMIT OF STUDY
MATCH LINE
SHEET

MATCH LINE SHEET 8

MATCH LINE SHEET 6

UPPER LIMIT OF STUDY

MATCH LINE SHEET 9

LEGEND

Approximate 100 Year Flood Hazard Area

Flow Arrow

Limits of flooding may vary from actual location on the ground.

SCALE 1:63,360

Base prepared from USGS 1:63,360 quads

SHEET 7 OF 17

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BELUGA SUBBASIN
ALASKA

FLOOD PLAIN MANAGEMENT STUDY

BELUGA AND CHICHANTNA RIVERS, BISHOP, CHICHANTNA, OLSON AND SCARP CREEKS

MATCH LINE TO SHEET 7

MATCH LINE SHEET 5

Lone Ridge

UPPER LIMIT OF STUDY

UPPER LIMIT OF STUDY

UPPER LIMIT OF STUDY

LOWER LIMIT OF STUDY

LOWER LIMIT OF STUDY

LOWER LIMIT OF STUDY

MOQUAWKIE INDIAN RESERVATION

LEGEND

Approximate 100 Year Flood Hazard Area

Flow Arrow

Limits of flooding may vary from actual location on the ground

0 1 2 3 MILES

SCALE 1:63,360

Base prepared from USGS 1:63,360 quads

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SHEET 6 OF 17

FLOOD PLAIN MANAGEMENT STUDY

CHUITNA RIVER, THREEMILE, LONE AND TYONEK CREEKS

MATCH LINE SHEET 4

MATCH LINE SHEET 6

UPPER LIMIT OF STUDY

LOWER LIMIT OF STUDY

TIDAL FLAT

Trading Bay Mud

Chakachatna River

Nikolai Creek

Old Tyonek Creek

Straight Creek

Congaboona Lake

Nikolai River

Trading Bay

LEGEND

Approximate 100 Year Flood Hazard Area

Flow Arrow

Limits of flooding may vary from actual location on the ground

1 0 1 2 3 MILES

SCALE 1:63,360

Base prepared from USGS 1:63,360 quads

SHEET 5 OF 17

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FLOOD PLAIN MANAGEMENT STUDY

CHAKACHATNA RIVER, CHUITKILNACHNA, NIKOLAI, OLD TYONEK AND STRAIGHT CREEKS

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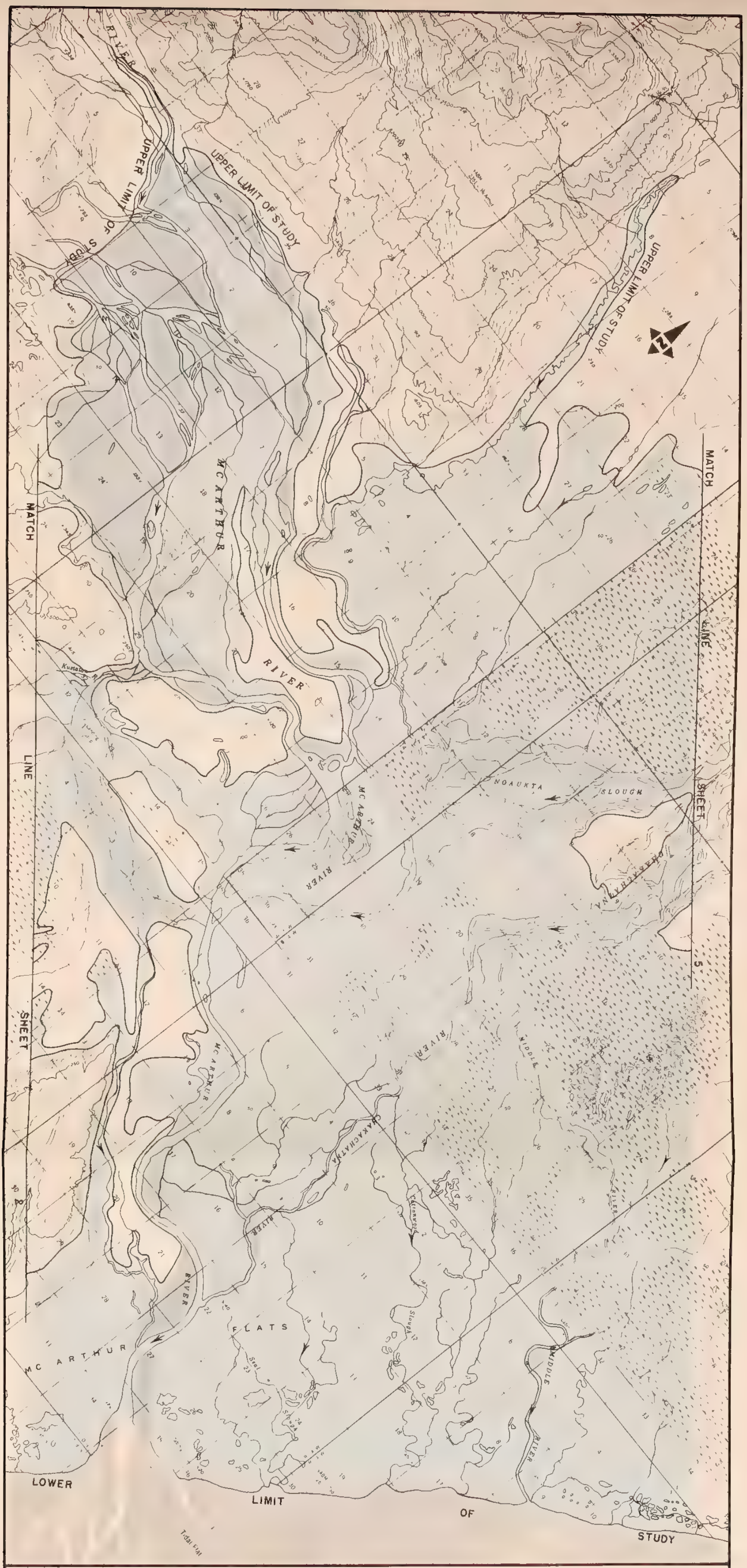
FLOOD PLAIN MANAGEMENT STUDY

CHAKACHATNA RIVER AND STRAIGHT CREEK

SHEET 4 OF 17



LEGEND

Approximate 100 Year Flood Hazard Area

Flow Arrow

Limits of flooding may vary from actual location on the ground

1 0 1 2 3 MILES

SCALE 1:63,360

Base prepared from USGS 1:63,360 quads

SHEET 3 OF 17

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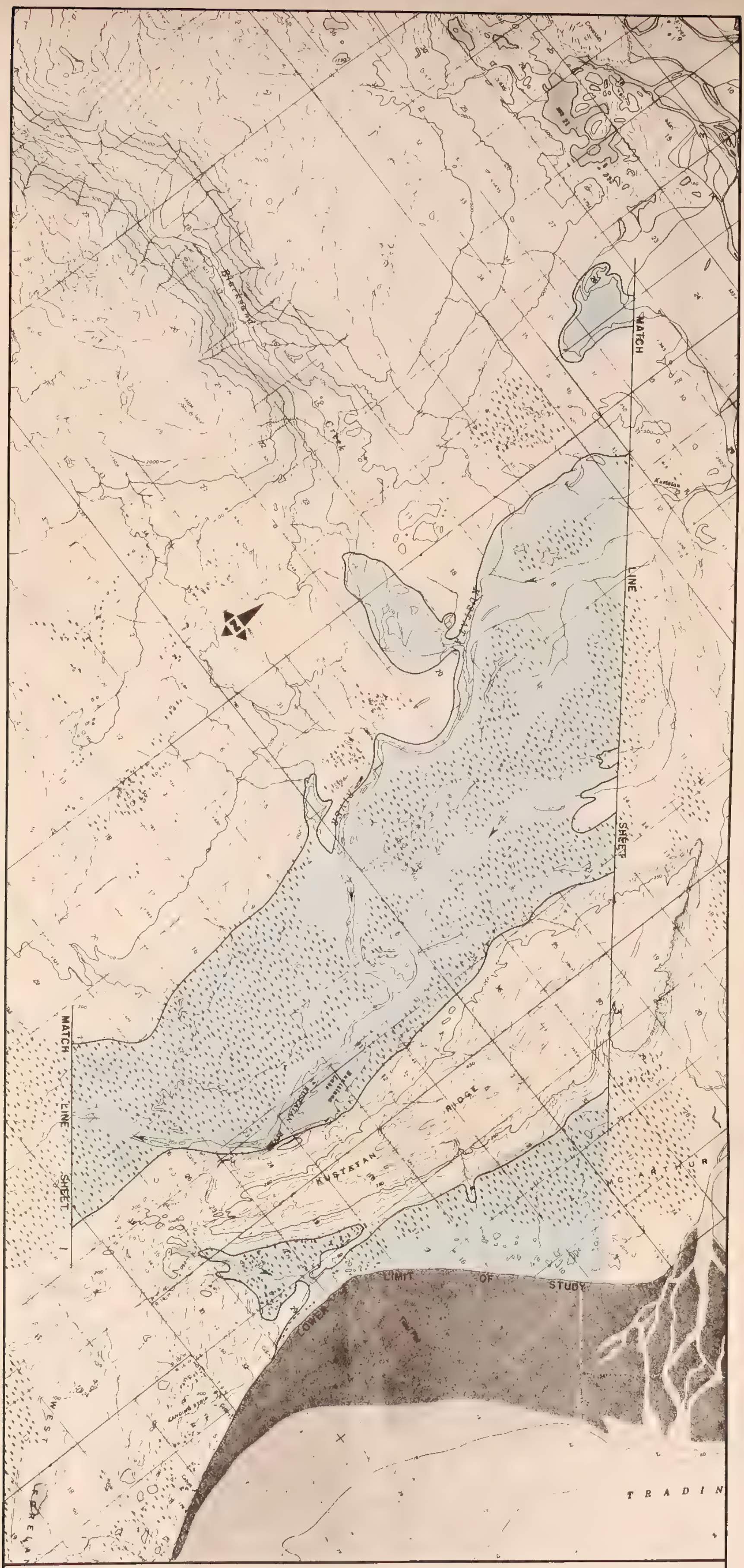
FLOOD PLAIN MANAGEMENT STUDY

CHAKACHATNA, KUSTATAN AND MC ARTHUR RIVERS



LEGEND

Approximate 100 Year Flood Hazard Area

Flow Arrow

Limits of flooding may vary from actual location on the ground

Base prepared from USGS 1:63,360 quads

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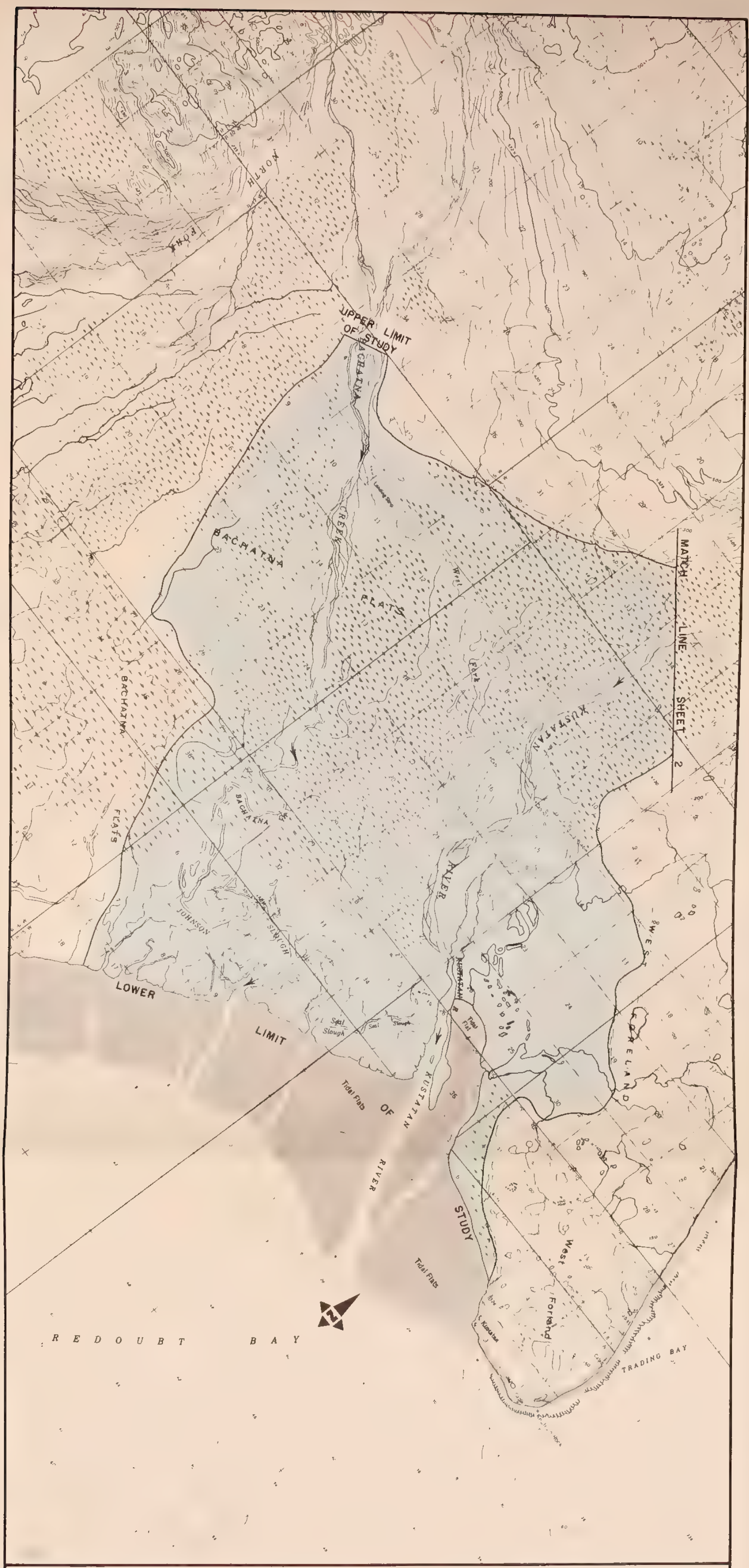
FLOOD PLAIN MANAGEMENT STUDY

KUSTATAN RIVER

SHEET 2 OF 17



LEGEND

Approximate 100 Year Flood Hazard Area

Flow Arrow

Limits of flooding may vary from actual location on the ground

1 0 1 2 3 MILES

SCALE 1:63,360

Base prepared from USGS 1:63,360 quads

SHEET 1 OF 17

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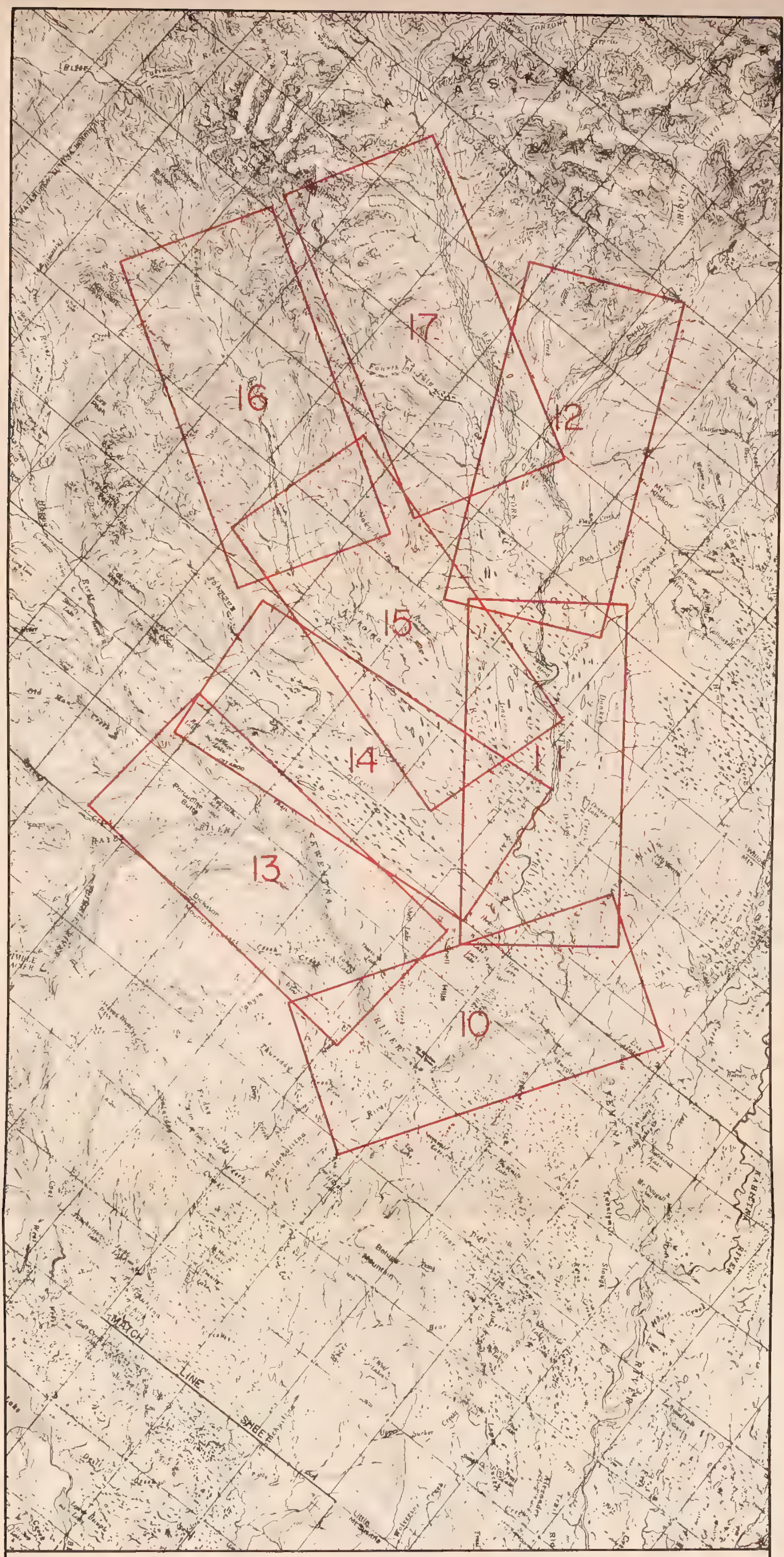
ALASKA

FLOOD PLAIN MANAGEMENT STUDY

KUSTATAN RIVER AND BACHATNA CREEK

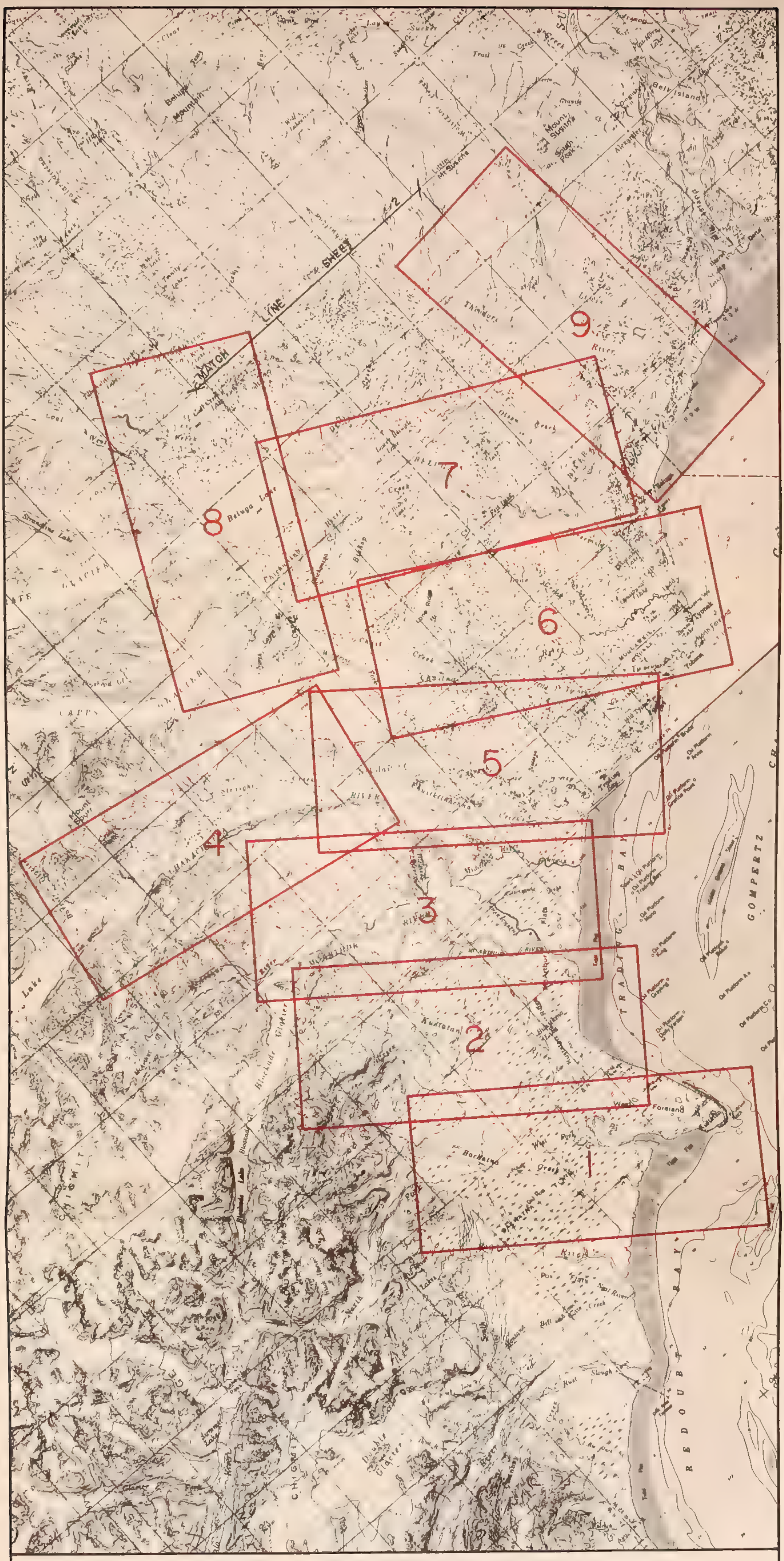


SHEET 2 OF 2

US DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
BELUGA SUBBASIN
ALASKA

MAP SHEET INDEX

BELUGA SUBBASIN STREAMS



LEGEND

5 Map sheet area coverage

5 0 5 10 MILES

SCALE 1:300,000

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SHEET 1 OF 2

MAP SHEET INDEX

BELUGA SUBBASIN STREAMS

MATCH LINE SHEET 12

UPPER LIMIT OF STUDY

Younestown Bend

PENTNA RIVER

KICHATNA RIVER

Gold Hill

Donkey Creek Lake

UPPER LIMIT OF STUDY

MATCH LINE SHEET 14

MATCH LINE SHEET 10

LEGEND

Approximate 100 Year Flood Hazard Area

Flow Arrow

Limits of flooding may vary from actual location on the ground

SCALE 1:63,360

Base prepared from USGS 1:63,360 quads

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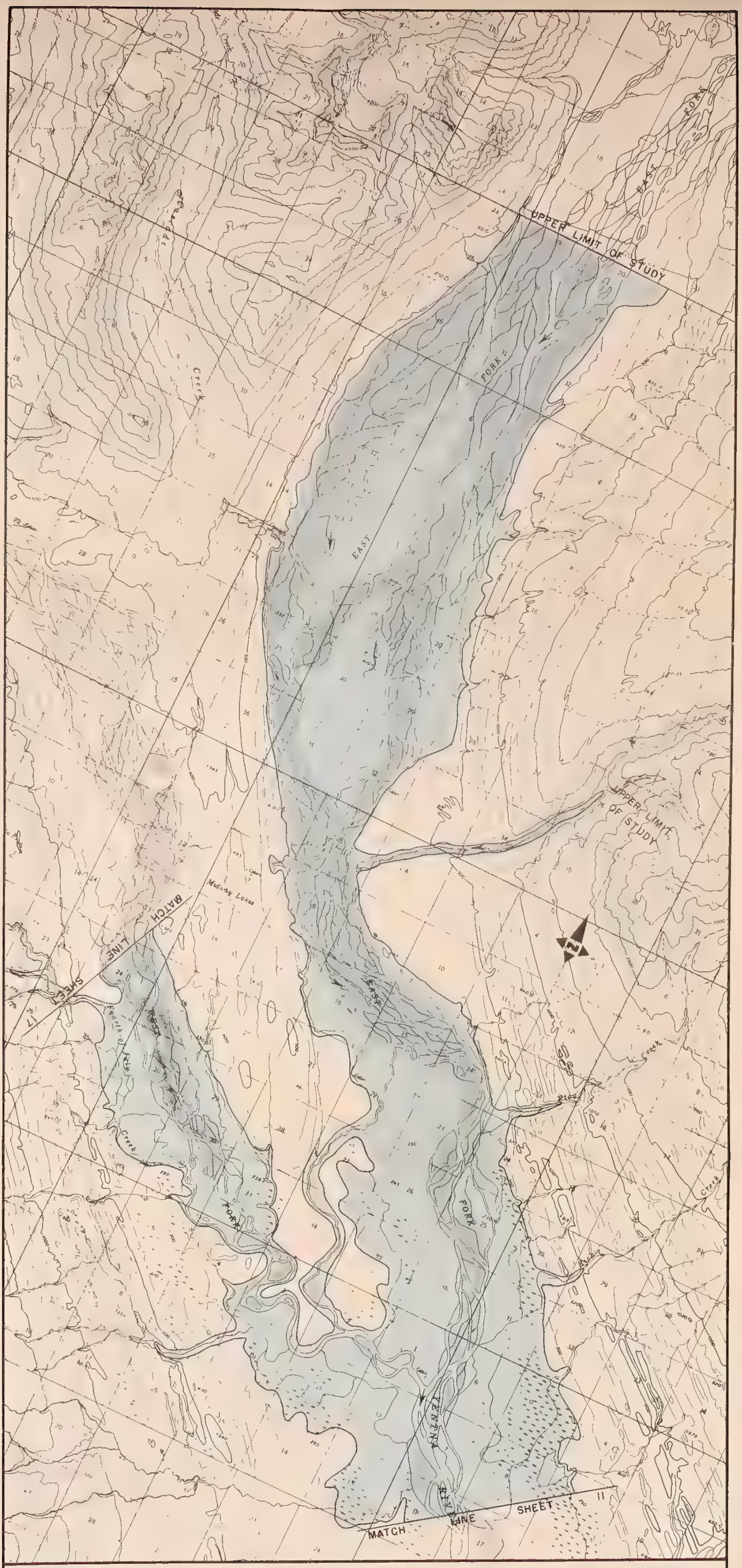
FLOOD PLAIN MANAGEMENT STUDY

KICHATNA AND YENTNA RIVERS, CLEARWATER, DONKEY, GAGNAN, JOHNSON AND RED CREEKS

SHEET 11 OF 17



LEGEND

Approximate 100 Year Flood Hazard Area

Flow Arrow

Limits of flooding may vary from actual location on the ground

0 1 2 3 MILES

SCALE 63 360

Base prepared from USGS 1 63 360 quads

SHEET 2 OF 17

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ALASKA

FLOOD PLAIN MANAGEMENT STUDY

EAST AND WEST FORKS OF YENTNA RIVER, FOURTH OF JULY CREEK

LEGEND

Approximate 100 Year Flood Hazard Area

Flow Arrow

Limits of flooding may vary from actual location on the ground

1 0 2 3 MILES

SCALE 1:63 360

Base prepared from USGS 1:63,360 quads

SHEET 13 OF 17

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FLOOD PLAIN MANAGEMENT STUDY

HAYES AND SKWENTNA RIVERS

LEGEND

Approximate 100 Year Flood Hazard Area

Flow Arrow

Limits of flooding may vary from actual location on the ground

SCALE 1:63,360

Base prepared from USGS 1:63,360 quads

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FLOOD PLAIN MANAGEMENT STUDY

JOHNSON AND RED CREEKS

SHEET 14 OF 17

LEGEND

Approximate 100 Year Flood Hazard Area

Flow Arrow

Limits of flooding may vary from actual location on the ground

0 1 2 3 MILES

SCALE 1:63 360

Base prepared from USGS 1:63 360 quads

SHEET 15 OF 17

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FLOOD PLAIN MANAGEMENT STUDY

KICHATNA AND NAKOCHNA RIVERS

LEGEND

Approximate 100 Year Flood Hazard Area

Flow Arrow

Limits of flooding may vary from actual location on the ground.

1 0 1 2 3 MILES

SCALE 1:63,360

Base prepared from USGS 1:63,360 quads.

SHEET 16 OF 17

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FLOOD PLAIN MANAGEMENT STUDY

KICHATNA RIVER

LEGEND

Approximate 100 Year Flood Hazard Area

Flow Arrow

Limits of flooding may vary from actual location on the ground.

1 0 1 2 3 MILES

SCALE 1:63,360

Base prepared from USGS 1:63,360 quads.

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FLOOD PLAIN MANAGEMENT STUDY

WEST FORK OF YENTNA RIVER, FOURTH OF JULY CREEK

SHEET 11 OF 17